6. $x^3+2x^2y-4y=7 \quad x=1 \quad \frac{dy}{dx}=?$

implicit

$3x^2+2x^2\frac{dy}{dx}+y\cdot 4x-4\frac{dy}{dx}=0$

$2x^2\frac{dy}{dx}-4\frac{dy}{dx}=-3x^2-4xy$

$\frac{dy}{dx}(2x^2-4)=\frac{-3x^2-4xy}{2x^2-4}\Bigg|_{\substack{x=1\\y=-3}} = \frac{-3-4(-3)}{2-4}=\frac{9}{-2}$

$x=1$

$1+2y-4y=7$

$-2y=6$

$y=-3$

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7. $\int_1^{e^2}\frac{x^3+1}{x}\,dx = \int_1^{e^2}x^2+\frac{1}{x}\,dx$

$=\frac{x^3}{3}+\ln|x|\Big|_1^{e^2}$

$=\left(\frac{e^6}{3}+\ln e^2\right)-\left(\frac{1}{3}+\ln|1|\right)$

$=\frac{e^6}{3}+2-\frac{1}{3}$

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8. $f(x) < 0$ for all x

$g(5) = 2$ initial conditions

$$h(x) = \frac{f(x)}{g(x)} \qquad h'(x) = \frac{f'(x)}{g(x)} \qquad g(x) = ?$$

$\to 0$ if $\int g'(x) = \int 0$

$$h'(x) = \frac{g(x)\,f'(x) - \cancel{f(x)\,g'(x)}}{(g(x))^2} = \frac{f'(x)}{g(x)}$$

so $g(x) = c$

$g(5) = 2 = c$

$$\boxed{g(x) = 2}$$

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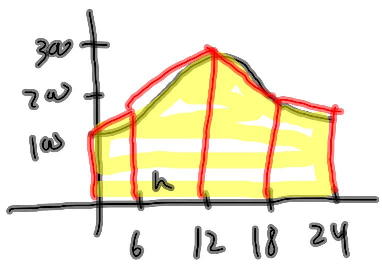
9. k $\frac{gal}{hr}$



total $= \int$ rate dt

$$T = \frac{6}{2}\left[100 + 2\cdot 200 + 2\cdot 300 + 2\cdot 205 + 100\right]$$

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Review #4 polar, parametric, vector functions

polar $r = f(\theta)$ $x = r\cos\theta$ $r = \sqrt{x^2+y^2}$

$y = r\sin\theta$ $\theta = \tan^{-1}\frac{y}{x}$

$r = 1$
$r = k$ circle

add π if QII
QIII

$r = a\sin(n\theta)$
$r = a\cos(n\theta)$ rose n even: 2n leaves per $= 2\pi$
n odd: n leaves per $= \pi$

$r = a + b\cos\theta$
$r = a + b\sin\theta$

$a = b$ cardioid
$a < b$ limacon with loop
$a > b$ limacon with dimple

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parametric

$$x = f(t)$$
$$y = g(t)$$

vecter $\hat{r}(t) = \langle x(t), y(t) \rangle$

$$\hat{r}(t) = x(t)\,\hat{\imath} + y(t)\,\hat{\jmath}$$

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solve

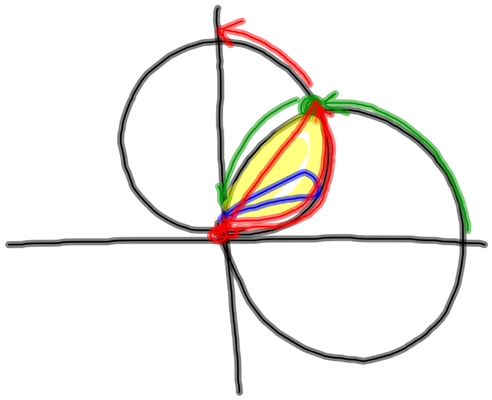
$r = 2\cos\theta \quad 0 \le \theta \le \pi$

$r = 2\sin\theta$

$2\cos\theta = 2\sin\theta$

$\cos\theta = \sin\theta$

$\theta = \frac{\pi}{4}$ ✓



$r = 0$

$0 = 2\cos\theta \quad 0 = 2\sin\theta$

$\theta = \frac{\pi}{2} \quad \theta = 0, \pi$

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